We Claim:

1. A method of preparing a photothermographic emulsion comprising:

(A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing the following steps (B-1) and (B-2) but not step (C) in either order or at the same time,

(B-1) providing an organic sulfur-containing compound in association with said preformed silver halide grains and said non-photosensitive source of reducible silver ions,

(B-2) converting some of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver halide grains, and then

(C) chemically sensitizing at least said preformed silver halide grains by decomposing said organic sulfur-containing compound on or around said silver halide grains in an oxidizing environment to provide a photothermographic emulsion comprising sulfur chemically sensitized photosensitive silver halide grains in reactive association with said non-photosensitive source of reducible silver ions.

2. The method of claim 1 further comprising mixing said photothermographic emulsion with a binder and coating the resulting photothermographic emulsion formulation onto a support.

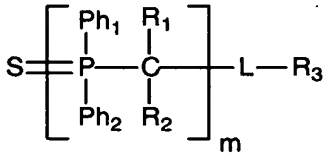
3. The method of claim 1 wherein said non-photosensitive source of reducible silver ions is a silver fatty acid carboxylate having 10 to 30 carbon atoms in the fatty acid or a mixture of said silver fatty acid carboxylates, as least one of which carboxylates is silver behenate.

4. The method of claim 1 wherein said organic sulfur-containing compound is a sulfur-containing spectral sensitizing dye comprising a ring structure having a thio, thiocarbonyl, or carbonyl group within said ring structure.

5. The method of claim 4 wherein said organic sulfur-containing compound contains a thiohydantoin, rhodanine, or 2-thio-4-oxo-oxazolidine nucleus, or any combination thereof.

6. The method of claim 1 wherein said organic sulfur-containing compound is a diphenylphosphine sulfide.

7. The method of claim 6 wherein said organic sulfur-containing compound is represented by the following Structure PS:



(PS)

wherein Ph_1 and Ph_2 are the same or different phenyl groups, R_1 and R_2 independently represent hydrogen, or a alkyl or phenyl group,, L is a direct bond or a linking group, m is 1 or 2 and when m is 1, R_3 is a monovalent group, and when m is 2, R_3 is a divalent aliphatic linking group having 1 to 20 carbon, nitrogen, oxygen, or sulfur atoms in the chain.

8. The method of claim 7 wherein R_1 and R_2 are both hydrogen or one of them is methyl, L is a direct bond or sulfonyl or carbonyl linking group, m is 1, and R_3 is an alkyl, aryl, or dialkylamino group.

9. The method of claim 1 wherein said organic sulfur-containing compound is provided in an amount of from about 10^{-6} to about 10^{-1} mol/mol of total silver from the non-photosensitive source of reducible silver ions in said photothermographic dispersion.

10. The method of claim 1 wherein said reducible silver ions are converted to photosensitive silver halide by one or more additions of a halogen-containing compound in an amount of from about 10^{-4} to about 10^{-1} mol of halogen atom per mol of reducible silver ions.

11. The method of claim 1 wherein said organic sulfur-containing compound is decomposed by the presence of a hydrobromic acid salt of an N-heterocyclic compound that is associated with a pair of bromine atoms.

12. The method of claim 1 wherein said organic sulfur-containing compound is decomposed by the portioned addition of an oxidizing agent.

13. The method of claim 1 wherein said chemical sensitizing step is carried out at a temperature of from about 10°C to about 30°C for up to 60 minutes.

14. The method of claim 1 further comprising, after said chemical sensitizing step, adding a spectral sensitizing dye to spectrally sensitize said photosensitive silver halide grains to from about 600 nm to about 1100 nm.

15. The method of claim 1 further comprising adding a reducing agent composition to said photothermographic emulsion.

16. The method of claim 1 further comprising adding a phosphor to said photothermographic emulsion.

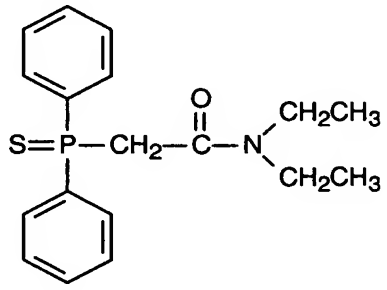
17. A method of preparing a black-and-white photothermographic emulsion comprising:

(A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing the following steps in order:

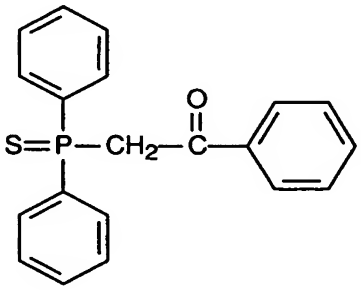
(B-1) providing an organic sulfur-containing compound in association with said preformed silver halide grains and said non-photosensitive source of reducible silver ions, said organic sulfur-containing compound selected from one of the two following groups of compounds:

a. one or more sulfur-containing spectral sensitizing dyes containing a rhodanine nucleus, and

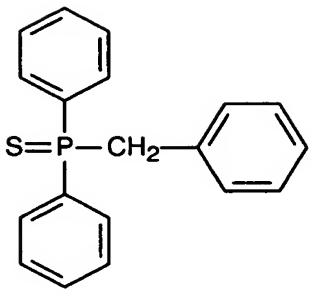
b. one or more of the following diphenylphosphine sulfide compounds PS-1 to PS-19:



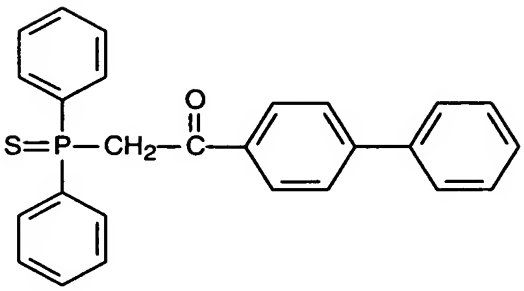
(PS-1)



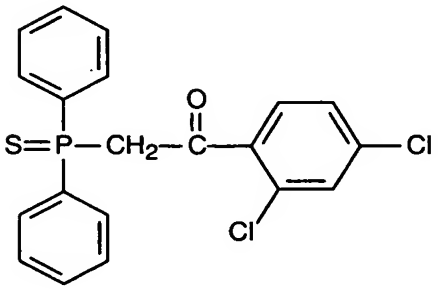
(PS-2)



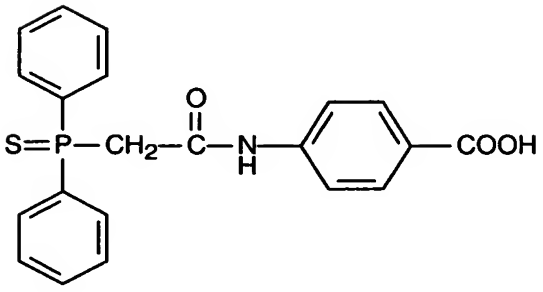
(PS-3)



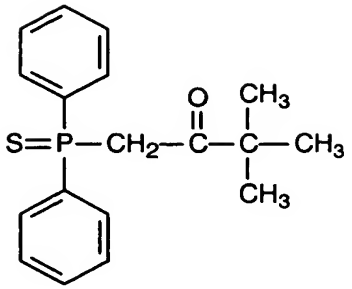
(PS-4)



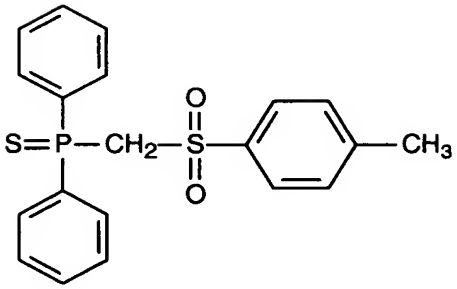
(PS-5)



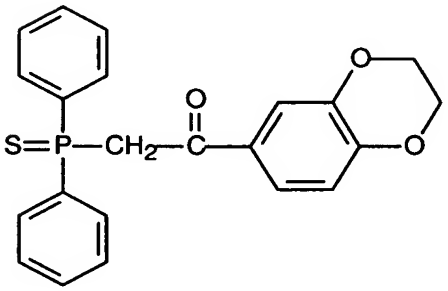
(PS-6)



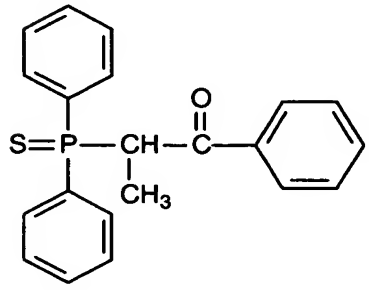
(PS-7)



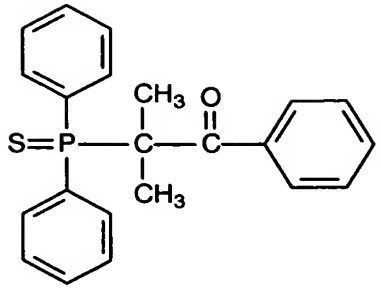
(PS-8)



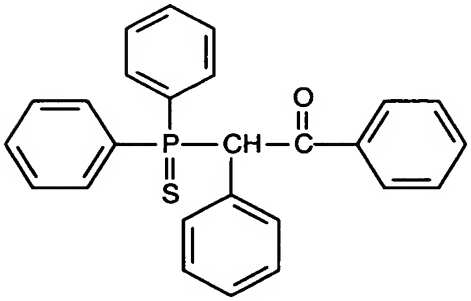
(PS-9)



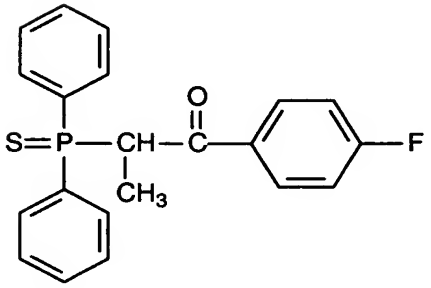
(PS-10)



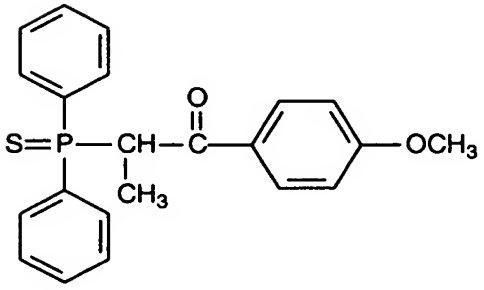
(PS-11)



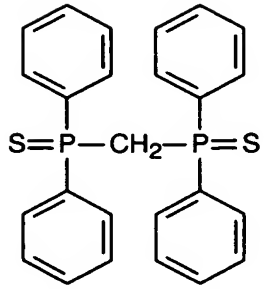
(PS-12)



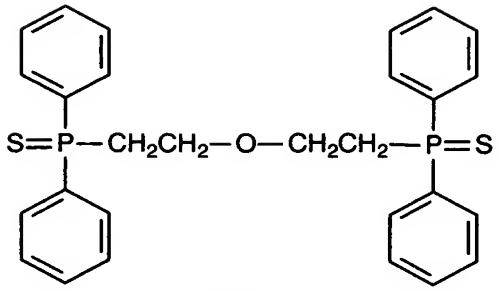
(PS-13)



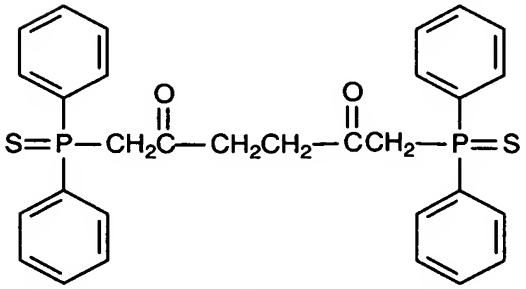
(PS-14)



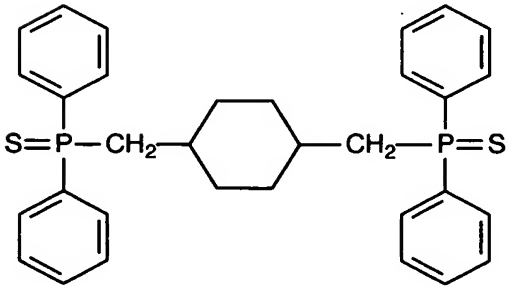
(PS-15)



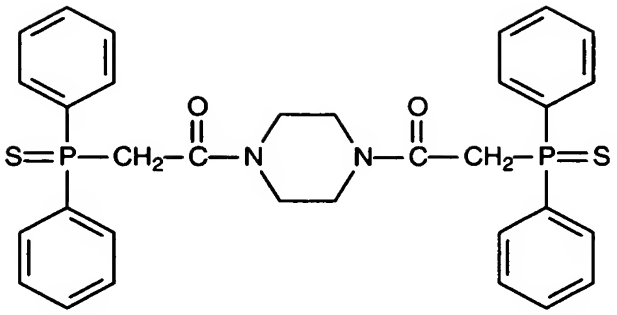
(PS-16)



(PS-17)



(PS-18)



(PS-19),

(B-2) converting from about 0.1 to about 10 mol % of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver bromide grains by addition of a bromide salt, and then

(C) chemically sensitizing at least said preformed silver halide grains by decomposing said organic sulfur-containing compound on or around said silver halide grains by the addition, in one or more stages, of pyridinium hydrobromide perbromide to the silver halide grains at from about 20°C to about 30°C for up to 60 minutes, to provide a photothermographic emulsion comprising chemically sensitized photosensitive silver bromide grains in reactive association with said non-photosensitive source of reducible silver ions comprising silver behenate.

18. The method of claim 17 further comprising the addition to said photothermographic emulsion of a spectral sensitizing dye to spectrally sensitize said photosensitive silver bromide grains to from about 600 nm to about 1100 nm.

19. The method of claim 17 further comprising the addition of one or more antifoggants, antistatic agents, toners, matting agents, development accelerators, acutance dyes, post-processing stabilizers or stabilizer precursors, thermal solvents, shelf-life enhancing agents, co-developers, contrast enhancing agents, or high-contrast agents to said photothermographic emulsion.

20. The method of claim 17 further comprising adding a phosphor to said photothermographic emulsion.

21. The method of claim 18 further comprising the addition of a hydrophobic binder to said photothermographic emulsion to provide a photothermographic emulsion formulation.

22. The method of claim 22 further comprising coating said photothermographic emulsion formulation on a support.

23. A method of preparing a photothermographic material comprising:

(A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing steps (B-1) and (B-2) but not step (C) in either order or at the same time,

(B-1) providing an organic sulfur-containing compound in association with said preformed silver halide and said non-photosensitive source of reducible silver ions,

(B-2) converting some of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver halide grains,

and then

(C) chemically sensitizing at least said silver halide grains by decomposing said organic sulfur-containing compound on or around said silver halide grains in an oxidizing environment to provide a photothermographic emulsion comprising chemically sensitized photosensitive silver halide grains in reactive association with said non-photosensitive source of reducible silver ions, and

(D) simultaneously with any of steps (A) through (C), or subsequent to (C), adding a binder to form a photothermographic emulsion formulation, and

(E) after step (D), coating and drying said photothermographic emulsion formulation on a support to provide a photothermographic imaging material.

24. The method of claim 23 wherein, simultaneously or subsequent to step (E), a protective overcoat formulation is coated over said photothermographic imaging layer.

25. The method of claim 23 wherein, prior to or simultaneously with step (E), a carrier layer is coated on said support underneath said photothermographic imaging layer.

26. The method of claim 23 further comprising coating a layer on a non-imaging side of said support.

27. The method of claim 26 wherein said layer coated on said non-imaging side is a conductive layer.